King County's SciFYI

King County
Department of Natural Resources and Parks
Water and Land Resources Division

A digest of current natural science issues in King County

April 2010 - SPECIAL EDITION

SPECIAL EDITION: KING COUNTY'S ENVIRONMENTAL LABORATORY

The Lab is located on Ewing St. near Seattle Pacific University, affording easy water access for its boats and sampling activities.

The Environmental Laboratory (Lab) provides quality field, laboratory, information technology services, and advisory services in support of King County and other publicly-sponsored programs that protect and enhance water quality. The Lab serves more than 150 King County projects, analyzes 15,000 samples, and produces close to 400,000 data points for use in environmental studies and decision-making.

Lab data are used to:

- *Monitor trends in regional waters*
- *Design and operate wastewater treatment plants*
- *Enforce industrial waste regulations*
- *Formulate plans and action programs to protect and enhance local water bodies*
- *Monitor recycled products such as Biosolids and reclaimed water*
- *Protect public health*
- *Participate in cooperative studies with other governmental and research agencies*

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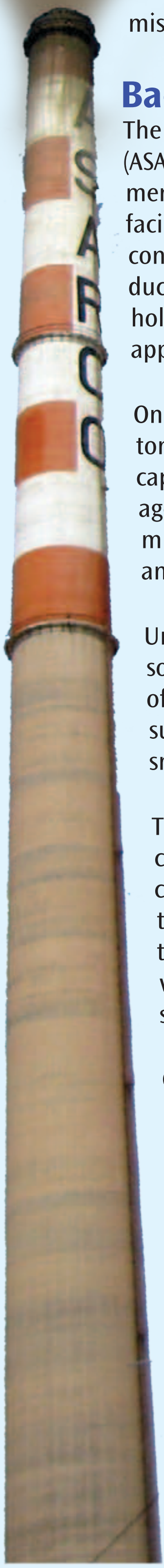
For more information on the Lab, visit the following web site: http://www.kingcounty.gov/environment/data-and-trends/environmental-lab.aspx or contact Kate Leone at kate.leone@kingcounty.gov

Environmental Lab, Public Health–Seattle & King County Collaborate on Tacoma Smelter Plume Study

By Diane McElhany, Environmental Laboratory Trace Metals Unit



King County departments are coordinating, communicating and collaborating to address regional issues, balance priorities and implement missions. The following illustrates one of these efforts.

Background

The American Smelting and Refining Corporation (ASARCO) operated a smelter on the shores of Commencement Bay near Tacoma for nearly a century. The facility began its life as a lead smelter in 1889 and was converted to a copper smelter in 1902. Copper produced there was used in electronics, roofing, household products, coins, and biomedical and chemical applications, among other uses.

One byproduct of copper smelting is arsenic. The Ruston smelter was one of the only smelters in the world capable of processing ore containing a high percentage of arsenic. In fact, the Ruston smelter collected much of its arsenic and sold it for use in insecticides and building materials.

Unfortunately, not all of the arsenic was captured and sold. Along with lead and other chemical byproducts of copper smelting, arsenic was released into the surrounding environment through a 562-foot-tall smokestack.

The smokestack sent pollutants far into surrounding communities. While the smelter was permanently closed in 1986 and the stack demolished in 1993, the environmental damage was done. We now know that lead and arsenic pollution was carried by the wind over a wide expanse and contaminated the soils of King, Pierce, Thurston and Kitsap counties.

Contamination in the area surrounding the smelter was so serious that in 1983 the United States Environmental Protection Agency included the smelter site, including a 23-acre peninsula built from slag, as part of a Superfund site called the Commencement Bay Superfund site.

The story

Starting in 1999, Public Health – Seattle & King County in collaboration with the Washington Department of Ecology embarked on a series of ASARCO plume grant-funded studies to characterize the nature and extent of lead and arsenic contamination throughout King County.

During the past 10 years more than 8,000 soil samples have been collected and analyzed from approximately 900 locations throughout King County. This research has allowed Public Health to accurately map the concentrations of dispersed arsenic and lead throughout King County.

Although Public Health approached the Lab in 1999 to analyze these samples, we did not have the appropriate resources to help with this exciting work. But in 2009 Public Health's Lee Dorigan approached us again and this time we were better equipped to take on the Trace Metals arsenic and lead soil analyses. The lab started analyzing samples in late 2009.

However, due to a rise of some other large public health priorities (H1N1 Flu and Howard Hanson Dam flood contingency planning) Public Health found itself with grant funding for sample collection, but not enough staff to carry out the work.

Without staff to do the sampling, this would also mean that, while the Lab's Trace Metals unit stood ready to continue the analysis, no samples would be available.

This led to further negotiations between Public Health, Ecology and the Lab that ultimately allowed the Lab's Environmental Services Unit (ESS) to step in and take over the sampling from Public Health in 2010, so that the project could continue and be completed before grant funding expired.

This is very exciting as a large part of this work is taking place at day care centers around King County. Because children have both potentially more exposure to and negative effects from toxic metals, Public Health and Ecology started more-focused assessments of child play areas in 2003.

This work has led to child areas being cleaned up, and part of this on-going grant project is to identify as many possible areas that would benefit from soil remediation.

It has been both educational and gratifying to work on a project that uses our data to make important decisions about the health and welfare of King County residents.

It has also been rewarding to work so collaboratively with another King County department to keep work moving forward despite the ever changing priorities and budget challenges faced by King County.

Much of the information in this article was taken from Public Health's Web site, http://www.kingcounty.gov/health/tsp. Please visit the website for much more information detailing their decade of handwork.

Environmental Lab and Industrial Waste: A Close Connection

by Kate Leone, Environmental Laboratory Manager

One of the Environmental Lab's key customers is King County's Industrial Waste Program. The mission of this program is to protect the environment, public health, biosolids quality, and King County's regional sewerage systems by regulating industrial and other discharges to the sanitary sewer.

The Lab has been working closely with the Industrial Waste Program for more than 30 years, providing data that helps the program know if industries are complying with their discharge permits, and to trace the source of illegal discharges to the sewer system.

In addition to the routine monitoring mentioned above, these units also provide support to Industrial Waste for special efforts.

LAB UNITS SUPPORTING INDUSTRIAL WASTE

The three units at the Lab that support Industrial Waste most closely are:

- **Conventionals** analyzes more than 30 inorganic parameters that are indicators of water quality. Tests for turbidity, dissolved oxygen and pH, and measurements of ultra low-level nutrients such as nitrogen and phosphorus, alert scientists to changes in the ecological balance of area waters. In addition to water quality measurements on samples from regional waters, Conventionals measures cyanide and biochemical oxygen demand in municipal and industrial discharges, analyzes for several parameters in biosolids, soils and sediments and characterizes contaminated drainage from construction sites.

- **Trace Metals** analyzes environmental, wastewater and industrial samples for more than two dozen potentially toxic metals. Of the many metallic elements found in the environment, some such as calcium, magnesium, zinc and copper are essential nutrients at low concentrations, but may be hazardous at higher levels. Others, like arsenic, lead, mercury and cadmium are toxic even at relatively low concentrations.

- **Trace Organics** measures trace levels of carbon-containing compounds found in air, liquids or solids. The unit routinely analyzes for federally designated priority pollutants and hazardous substances such as pesticides, PCBs, volatile solvents, byproducts of fuel combustion and other potentially toxic or hazardous organic contaminants. Additionally, Trace Organics has developed analytical techniques to analyze for endocrine-disrupting compounds and other analytes that are being used to evaluate the health of our lakes, streams and Puget Sound.

One such effort was the work started in late 2008 for the new Brightwater treatment plant's local limits study. By evaluating current discharge concentrations at a variety of locations during a year period, Industrial Waste will be able to better establish appropriate discharge permit levels for customers connected to the new treatment plant. The lab analyzed 663 samples for 671 different compounds at low levels to establish a large data set. This data set gives Industrial Waste staff the information they need to formulate meaningful discharge limits to utilize in regulating industries in the Brightwater service area.

Another special effort was Trace Metals' work to aid Industrial Waste's monitoring of several large industries that were permanently closing their doors. This process went on for several months and involved many quick-turn samples a week as these industries were treating and eliminating a wide variety of chemical discharges as part of their waste streams.

Such samples are always challenging because they are often highly buffered and are therefore prone to digestion explosions and frequently require extra analytical quality control measures to insure the accurate quantitation of priority pollutant metals.

Finally, Trace Organics recently completed an air deposition phthalate project requested by Industrial Waste. The project was to collect rainwater in specially prepared sample carboys, which are rigid containers designed to transport fluids. The carboys were deployed around the lower Duwamish waterway in parking lots and on rooftops.

After several weeks or depending on the amount of rainfall, the carboys were returned to the lab for low-level phthalate and polyaromatic hydrocarbon analyses. Phthalates are substances added to increase the flexibility, transparency, and durability of plastics. Polyaromatic hydrocarbons are chemical compounds that are produced as byproducts of the combustion of fuels.

The goal of the sampling was to evaluate the atmospheric deposition pathway for selected chemicals of concern that pose a risk to contaminate sediments in the lower Duwamish waterway. The sampling measured a combination of dry and wet deposition in urban/industrial neighborhoods with the results being comparable to studies conducted in other urban/industrial areas.

Whereas it was previously thought that phthalates were deposited primarily from rainfall, data from this study suggests that heavier semivolatile organic compounds are predominantly deposited via both wet and dry deposition.

For more information related to Industrial Waste programs and services see the link below.
http://www.kingcounty.gov/environment/wastewater/Industrial-Waste.aspx

New Instruments Aid Trace Organics Analyses

By Mike Doubrava, Environmental Laboratory Trace Organics Unit

The Trace Organics unit at the King County Environmental Lab has purchased and installed three new Gas Chromatography (GC) systems with "fast analysis" capabilities. The new GCs replaced three systems that were more than 10 years old.

The new GC systems are more cost-effective and efficient for pesticides, PCBs, and fuels analyses. One major advancement is the new GC oven design which allows faster temperature increases. The newer ovens can ramp up at 50 degrees centigrade per minute compared to only 25 degrees centigrade per minute on the older systems.

The benefit of faster ramp up rates will drop analysis times by about 50 percent, which enables Trace Organics scientists to keep up with a heavier workload.

Along with the oven redesign, the new GCs have the capability of back flushing the column after sample injection. Over repeated injections of samples with higher organic matrix, the front of the column can become coated which diminishes the separation and sensitivity aspects of the column.

Normally, several hours of column maintenance would be performed. The ability to back flush or "clean" the front of the column after sample injections reduces maintenance downtime and prolongs the life of the column.

The new GCs will also use hydrogen as a column carrier gas. With this in place, analysts should see better compound separation, resolution and sensitivity. This should also provide opportunities to make assessments at lower detection limits and compound identification.

Using hydrogen, along with column back flushing, will help keep the columns cleaner, resulting in a reduction of maintenance and chromatography troubleshooting.

For projects where fuels analyses are requested "fast" GC will aid in petroleum identification for samples contaminated with complex mixtures. The increased column separation of compounds should make it possible to further identify or confirm the presence of fuel constituents; for example, diesel further separated from lube or motor oil.

A project where the "fast" technology should pay immediate dividends is the King County Roads' Street Waste Alternative Program (SWAP). Samples from SWAP piles generated from collected vactor wastes and street sweepings are analyzed over a period of time for petroleum products in order to identify decreases in concentrations of the diesel and lube oil(s).

Once the new temperature programs are developed and tested for projects where pesticides and/or PCBs analyses are requested, the "fast" GC method should be more efficient in separating compounds from each other and/or from interferences. This would increase confidence in identification, quantitation and confirmation of analytes present or not in samples.

One program where this is helpful is in sediment remediation. The Duwamish/Diagonal sediment samples can be challenging to analyze for pesticides due to higher concentrations of PCBs.

The "fast" GC should aid with resolving the pesticide peaks from the PCB peaks in the chromatogram. Once the peaks are resolved, the analyst will have more information to determine the absence or presence of pesticide analytes in the sample.

For compounds analyzed by "fast" GC, the sensitivity of detection should increase due to a combination of back flushing and hydrogen as a carrier gas. Projects requiring National Pollution Discharge Elimination permits, such as treatment plants and stormwater systems often request "best possible" detection limits for analyses.

Once method development is completed and tested, the new GCs should be able to analyze lower concentration calibration standards. This would result in lower instrument detection of analytes, which could redefine "best possible" treatment.

The Lab will continue to enhance its technologies to provide more cost-effective and efficient services for customers and clients.

If you would like further information related to these services feel free to contact Mike Doubrava at 206-684-2355 or by e-mail michael.doubrava@kingcounty.gov.

John A. Blaine

*By Ben Budka, Supervisor,
Environmental Laboratory Environmental Services Unit*

After 31 years of service to Metro and King County, marine water and sediment expert John Blaine retired on April 1. John will leave King County with a number of significant accomplishments as his legacy, and he will be greatly missed by all those who worked with him.

John started with Metro in 1978, analysing microbiological samples at the West Harrison building in downtown Seattle. He progressed through a series of positions to become a Lab Scientist and the lead skipper of the R/V *Liberty* at the Lab. He worked on almost every type of water quality and sediment sampling effort during his lengthy career.

John's primary work with Metro/King County involved marine water and sediment projects. He was involved in the Seahurst studies, where he designed and implemented Metro's in-situ Conductivity, Temperature, Depth (CTD) profiler system.

He managed the field coordination of Metro's Waterfront Cleanup program; was involved in the initial planning stages of the Elliott Bay/Duwamish River Restoration Program; and since 1979 has been the Environmental Services Section technical coordinator for Metro's National Pollution Discharge Elimination System Receiving Water Monitoring program and the King County Marine Ambient program.

John helped draft the original Puget Sound Estuary Program Protocols, found a more cost-effective and reliable way of accurately positioning the Liberty during sampling operations for the Denny Way Capping Study, and managed field operations for the Duwamish Head Baseline Study.

John was an innovator and took the initiative to invent and develop Metro's one-of-a-kind in-situ large-volume particulate sampler. This sampler allowed us to collect uncontaminated suspended solids for organics analysis.

John also developed a customized, high-quality CTD system, including the necessary *Liberty* modifications for handling the CTD underwater package and topside support equipment. His technical expertise was on display during the research, development and eventually the purchases for our underwater Remotely-Operated Vehicle, a state-of-the-art acoustical Doppler system, and the installation of *Liberty's* Differential Global Positioning Systems.

John continuously developed safety programs for field staff at the lab and was a significant resource for all lab personnel and other staff at the: National Oceanic and Atmospheric Administration, Washington State Department of Ecology, and United States Army Corps of Engineers.

We wish him, his wife, Lauren, and children Emily and Ben all the best in the years ahead.

Sediment TIEs: Making the Connection

Fran Sweeney, Environmental Laboratory Aquatic Toxicology Unit

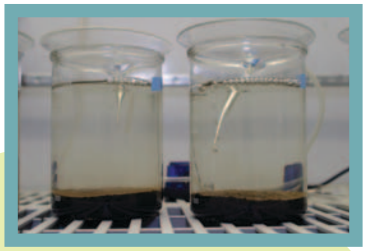
Background

Toxicity testing, also known as bioassay testing, is a common method of assessing whether contaminants present in an environmental sample pose an environmental risk. Methods called **Toxicity Identification Evaluation**, or **TIE,** offer a direct connection between toxicity test results and the cause of the toxicity.

Some specific applications of TIE methods include:

- Assisting in the development of total maximum daily load (TMDL) allocations for water bodies impaired due to sediment toxicity. This would require the identification of chemicals responsible for toxicity.
- Meeting the requirements of a National Pollution Discharge Elimination System (NPDES) permit that would have requirements to investigate the source of any toxicity found during outfall monitoring.

Sediment TIE procedures are an integral part of these types of investigations and one of the primary tools used in the process. (Anderson et al 2007).



Finding the cause of toxicity in any sediment investigation is an important step so that source control and reduction efforts can be directed properly, cost effective clean up standards can be developed, and ultimately the environmental risk posed by the contaminants reduced to an acceptable level.

What is a Toxicity test?

In a toxicity test, marine organisms are exposed to test sediments in the laboratory. A toxicity test indicates the bioavailability of a contaminant, which is the portion of a compound that can pass into an organism. The typical effects that are looked at in a sediment toxicity test include mortality or more subtle biological effects such as reduced growth, impaired reproduction or abnormal development.

Sediment toxicity testing is widely used for compliance with the Washington State Sediment Management Standards (SMS). The common methods used for SMS testing include:

- A 10-day mortality test with the marine amphipod
- A 96-hour larval development test with mussels, oysters or sand dollars
- A 20-day growth test with a marine polychaete worm

One limitation of toxicity testing is that they only tell you if a sample is toxic or not and in certain cases to what degree. This limitation can be mitigated to some extent by conducting simultaneous sampling for toxicity testing and chemical analyses, but still the exact cause of toxicity often is elusive.

This is due to several factors:

- Unmeasured chemicals may be present,
- Multiple contaminants may correlate to the toxic response,
- These multiple contaminates may have varying degrees of bioavailability,
- The uncertain interactive toxicity of mixtures all add to the challenge of identifying the cause of toxicity (EPA, 2007).

The TIE

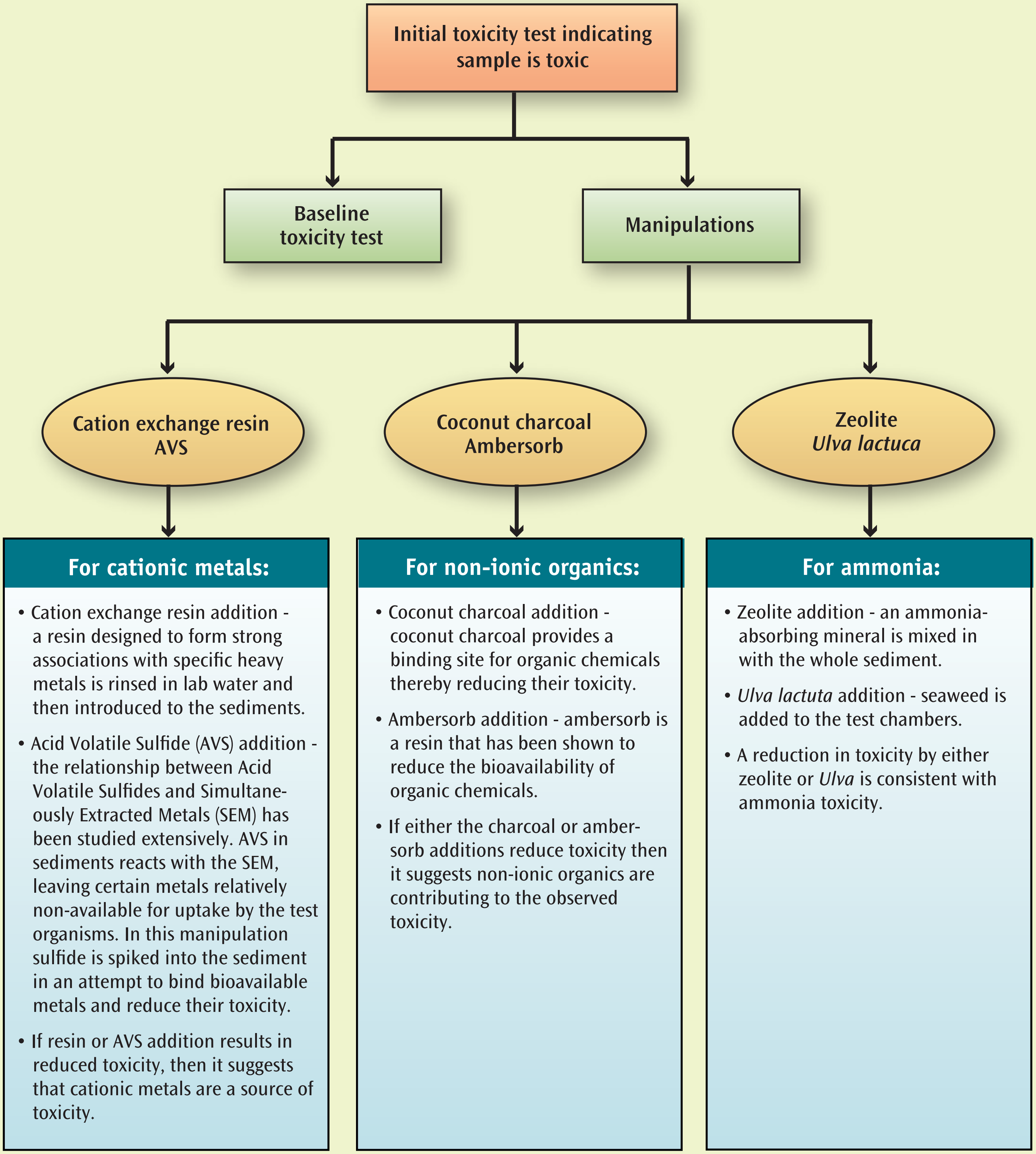
TIE offers a direct connection between toxicity test results and the cause of the toxicity. Originally developed in the late 1980s and early 1990s to identify the causes of toxicity in industrial and municipal wastewaters, TIE methods have been adapted to sediments.

The basic concept of a TIE is to manipulate a sample in an attempt to change the potency of a toxicant. The biological response of the test organism is used to determine if the sample manipulation successfully altered the toxicant and reduced its potency (EPA, 2007).

Figure 1:

PHASE I SEDIMENT TIE FLOW CHART

(Adapted from EPA, 2007)



A TIE begins with baseline testing to confirm toxicity. Once toxicity is confirmed multiple manipulations are performed targeting different classes of contaminants (organic chemicals, cationic metals and ammonia) in what is referred to as a Phase I TIE (see Figure 1 on previous page).

Test Interpretation and Limitations

Interpretation of a TIE differs from a standard Sediment Management Standards toxicity test where the results are statistically compared to a reference sediment – clean sediment that is similar to the test sediment.

In a TIE, the results of manipulated samples are compared to the baseline sediment toxicity and an appropriate blank sample for each of the manipulations above. When toxicity is removed it suggests that class of chemicals is contributing to the toxicity. Ideally, both manipulations under each chemical class will reduce toxicity and the sediment chemistry will support the same conclusion.

A simplified example would be that both the zeoloite addition and *Ulva* treatment clearly reduce toxicity to amphipods while the sediment chemistry shows ammonia concentrations well above the values reported in the literature as being acutely toxic to amphipods.

The class of contaminants identified by Phase I (characterization) as contributing to toxicity will move on to more focused, confirmatory testing in Phases II (identification) and III (confirmation).

However, contaminated sediments are often complex mixtures, with multiple contaminants possibly contributing to toxicity. This can make the interpretation of the Phase I TIE results a challenge.

There are limitations to the current suite of Phase I manipulations. For example:

- Cation exchange resins can also cross-react with ammonia and endosulfan (EPA, 2007). These resins also won't account for anionic metals such as arsenic and selenium.
- The current suite of Phase I manipulations are not sensitive to dioxin or dioxin-like toxicants. Nor are they sensitive to mercury toxicity (Ho *et al.* 2009).
- On the organics side, PAHs can be problematic and may not respond to the typical Phase I manipulations of coconut charcoal addition (EPA, 2007).

Therefore, knowledge about site conditions is essential to planning and designing a Phase I TIE and non-standard manipulations may be necessary to account for unique site conditions.

A well designed Phase I study developed with knowledge of the unique site conditions can provide a great deal of information of the contaminants contributing to toxicity. This will provide direction for the next steps, but it won't definitively identify a specific chemical. For that, additional levels of identification and confirmatory testing focused on a specific class of chemicals are necessary.

Closing

Finding the cause of toxicity is a significant step in any sediment investigation so that source control and reduction efforts can be directed properly, cost effective clean up standards can be developed, and ultimately the environmental risk posed by the contaminants reduced to an acceptable level.

For more information on this project you may contact Fran Sweeney by phone; 206-684-2358 or by e-mail: Francis.Sweeney@kingcounty.gov

References and Additional Readings

Anderson BS, Hunt JW, Phillips BM, and Tjeerdema RS, 2007. Navigating the TMDL Process: Sediment Toxicity. WERF Research Report 02-WSM-2. Water Environment Research Foundation, Alexandria Virginia.

EPA, 2007. Sediment Toxicity Identification Evaluation. Final Report EPA/600/R07/080. US Environmental Protection Agency, Office of Research and Development, Washington DC.

Ho KT, Burgess RM (2009). Marine Sediment TIEs: History, Principles and Future Research. Env Chem. Vol. 5, Part T (2009): 75-95.

Small but Mighty: VideoRay ROV is Versatile Member of the Environmental Lab Crew

By Jim Devereaux, Environmental Laboratory Environmental Services Unit

This remotely operated video camera goes where divers or other equipment cannot go, used for projects ranging from eelgrass surveys, wastewater facility inspections, lost equipment recovery to searches for submerged human bodies.

The Lab's Environmental Services unit purchased a VideoRay Pro 3 XE GTO Remotely Operated Vehicle (ROV) in 2007 as a result of interest from Lab customers in obtaining underwater video. Since then, the ROV has been deployed dozens of times for projects ranging from eelgrass surveys and lost equipment recovery to searching for submerged bodies. The ROV has proven to be extremely capable and has provided results that have met and often exceeded project managers' expectations.

The VideoRay ROV is one of the smallest ROVs available on the market, making it extremely versatile and capable of going places that larger units can't access. Considering its small size, the ROV is very capable, with two cameras, lights, sonar, two high-powered thrusters and a manipulator.

Because the ROV is often deployed in limited visibility waters, the BlueView 900 KHz sonar is vital to the success of most missions. The sonar has a range of about 180 feet and is critical when attempting to locate items or navigate in murky waters.

The Environmental Services Unit has assembled a four-person team that operates and maintains the ROV. Specific roles are assigned to each team member for each project. Depending on the project, anywhere from two to all four members may be needed. Roles include the ROV operator, tether handler, video and sonar operator, and project oversight and communications point person.

Thanks to the small size of the system, deployment can be from many different platforms. The ROV has been deployed from three different boats: the 43-foot-long *Liberty,* the 24-foot-long *Chinook* and the 17-foot-long Wooldridge *Chuck* The ROV can also be operated from a van when deployed in a manhole or other on-land structure.

The Lab's ROV has been used in dozens of projects since it was purchased. The most consistent work has been for King County's Wastewater Treatment Division (WTD) facility inspections. Some of the inspections have included the outfall pipes for Hanford, Murray, 53rd, 63rd, Barton, Sweyolocken, Dexter, Densmore, Montlake, South Mercer and University pump stations as well as the South Treatment Plant emergency bypass outfall (EBO).

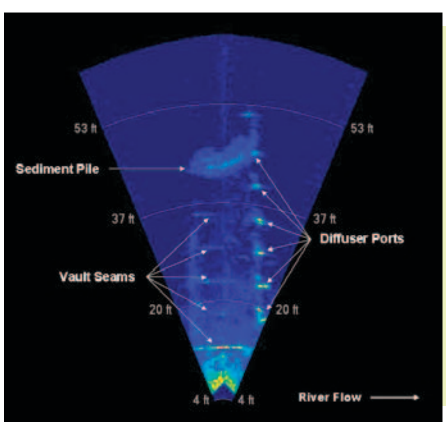
Of the facility inspections the Lab has conducted, 53rd Avenue and Renton EBO were particularly interesting, according to Jeff Bowman, WTD Facilities Inspection.

"I guess I like the ROV's ability to 'go where no man or machine has gone before,' giving us a valuable perspective of not only pipe condition but more importantly of sediment depth and blockages," he said.

"Previously with contract divers, we were only able to visually inspect the outfall openings or exposed pipe with very limited access. Now we can swim as far as the tether can take us inside the pipe."

Bowman said the crew was surprised to discover that the 53rd Avenue Outfall was completely blocked in at least two areas with sand that filtered in from apparent pipe separation.

"There is not a more suitable technology for confined underwater inspections, and I'm sure glad that we have this tool in-house," he said. *(Continued on page 10)*



The Renton EBO was a difficult inspection because of extremely low visibility, making the sonar capabilities vital for navigating more than 500 feet of pipe, and for determining the condition of the outfall diffuser structure. Based on the sonar images, staff was able to determine that there was a significant build up of sediment at the end of the structure.

Science Seminar–April 27th

8am – Noon, 8th Floor Conference Center
King Street Center

SESSION I: STORMWATER MONITORING

Moderator: Doug Navetski

8:10-8:30am **Puget Sound Stormwater Monitoring Work Group Update,** *Jim Simmonds*

8:30-8:50am **Preliminary Results of NPDES Stormwater Permit Monitoring,** *Dean Wilson*

8:50-9:10am **A Fecal Pollution and Correction Program in Kitsap County,** *Mindy Fohn*

9:10-9:30am **Theo Foss Waterway Source Control Strategy,** *Dana de Leon*

9:30-9:50am **Storm Drain and Combined Sewer Overflow Source Evaluations in the Duwamish Waterway Drainage Basin,** *Debra Williston and Beth Schmoyer*

BREAK (9:50-10:00am)

SESSION II: WLRD MONITORING

Moderator: Jo Wilhelm

10:00-10:20am **Monitoring Salmon Recovery in WRIA 8,** *Scott Stolnack*

10:20-10:40am **Status of King County Streams,** *Deb Lester*

10:40-11:00am **Framework and Status of Regulatory Effectiveness Monitoring,** *Gino Lucchetti*

11:00-11:20am **Development of a Monitoring Framework for the River and Floodplain Management Section,** *Sarah McCarthy*

11:20-11:40am **An Overview of the CIP Monitoring and Maintenance Program's Approach to Monitoring – Past and Present,** *Dan Eastman*

PANEL DISCUSSION

Moderator: Josh Latterell

11:40am-12:00pm *Speakers et al*

**Contact Jim Simmonds or Kate O'Laughlin if you'd like to attend the seminar, as space is limited.*

ROV article, continued from page 9

ESS has also conducted two inspections of the lake line flap gates in north Lake Washington for WTD. The images that were provided from these inspections were helpful for determining needed maintenance.

The ROV was a significant investment up front, but has more than paid for itself with the lost equipment it has recovered. One of those items was a $75,000 water quality instrument that measures conductivity, temperature and depth. The instrument, known as a CTD, broke free from the crane on Liberty during in rough seas off Alki Point in Puget Sound. Soon after the mishap, the crew was on site with the ROV.The ROV's BlueView Sonar was quickly able to locate a sonar target in the vicinity that appeared to have the correct signature. Once within visual range, the crew was able to identify the CTD with the ROV camera. The ROV attached a retrieval line and in less than 10 minutes, the CTD was back on board the Liberty.

For more information on the Lab's ROV and services, contact Ben Budka, 206-684-2328 or ben.budka@kingcounty.gov or Jim Devereaux, 206-684-2398, or jim.devereaux@kingcounty.gov.

About King County's Sci FYI

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